Discussion Paper No.8

Greenspace and Natural Areas

Prepared for

The Regional Chairman's Task Force on
Sustainable Development

by

The Regional Municipality of Hamilton-Wentworth
Planning and Development Department
Regional Planning Branch
Hamilton, Ontario

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1. Introduction

1.1 Purpose

This discussion paper is about the relationship of the ideas of sustainable development to "greenspaces" and natural areas in the Region. This includes, general discussion of; the natural history and remnant natural areas in the Region, sustainable development values and goals and a range of management concepts and techniques applicable to greenspace/natural area issues. The purpose of the discussion paper is to help stimulate thinking on the development of a vision for natural areas and greenspace by the Sustainable Development Task Force.

1.2 Origins of Sustainable Development

The Brundtland Commission report which popularized the concept of sustainable development determined that in the course of meeting its needs the earth's expanding population of humans was wreaking havoc on ecological systems (the atmosphere, soils, waterbodies, forests). The report explicitly recognized the interconnections between all life on the planet, carrying the message that despite differences in wealth and lifestyle all people shared a common future because they shared the global environment.

The Brundtland report also determined that one of the root causes of the destructive activity was the inequitable sharing or use of the resources extracted from the natural environment. When carried to its logical conclusion in the context of a growing world population the agenda of sustainable development called for fundamental changes in the relationships of social, economic and environmental systems.

1.3 Sustainable Development and Natural Systems

The working interpretation of sustainable development by the Sustainable Development Task Force encompasses, among other things, the;

> maintenance of ecological integrity through careful management, rehabilitation, reduction in wastes and protection of diverse and important natural species and systems.

2. Natural History of the Region

The character of the regional landscape has been determined by the processes of natural history; geology, climate, precipitation and drainage, and the rise and decay of vegetative and animal communities.

2.1 Geology and Landform: Bedrock and Escarpment

The sedimentary limestone and shale bedrock in the Region formed over millions of years during the Palaeozoic age. Beneath this bedrock is the older Precambrian rock of the Canadian Shield.

500 to 400 million years ago warm water seas covered the Great Lakes basin and Southern Ontario. The bodies of many varieties of sea organisms sank to the bottom. The calcium (lime) in the coral reefs cemented together with the other marine organisms to form limestone including one particularly hard type, dolomite.

Rivers carried eroded material into this sea from the newly formed Appalachian Mountains. Over time the clays and sand collecting on the bottom of the sea were compressed into sandstone and shale by the weight of the water and the other materials settling on top. Therefore, sandstone and shale beds separate layers of limestone showing that the coastline and level of the sea changed considerably over time. These alternating layers can be seen in the exposed escarpment face. The final period in the life of the sea (Silurian) was a time of coral reefs. Therefore the top layer of bedrock is a hard cap of limestone dolomite (Lockport).

Once the sea disappeared, rivers and rainfall eroded the basically flat and featureless limestone rock for about 300 million years. In places these processes carved through the hard dolomite. Then the softer shales and sandstones eroded much more quickly. Cliffs (or scarps) of limestone formed in areas where softer rock was being carved away. Also part of the sea bottom had subsided leaving a higher rim. Along this rim the different strata in the rock were exposed and differences in elevation were created. In this way the Niagara Escarpment was formed.

2.2 Glaciation and Physiographic Features.

Most recently (in the million years or less of the Pleistocene era) four successive periods of glaciation saw vast, heavy sheets of ice move across Southern Ontario scouring the bedrock, breaking and pulverizing the pieces, while pushing and shaping the debris.

A succession of post-glacial lakes formed and reformed in the periods between glaciation, Maumee, Whittesley, Warren, Iroquois, Algonquin. Areas of sand were formed at the edges of the lakes and clay was deposited on the bottom.

About 12,000 years ago the ice left Southern Ontario for the last time; "the Wisconsin retreat". Till, the pulverized rock materials suspended in the ice, was left behind. Many of the typical shapes the glaciers and the huge volumes of meltwater left behind are found in the Region; e.g. ridges of till called moraines, the distinct long oval hills called drumlins, and the hilly spillway deposits of sand and gravel formed by great rivers.

Near the end of the last ice age the Great Lakes gradually began to take the shape we know today but were substantially larger at the outset. "Lake Iroquois" occupied the Lake Ontario basin but the shores were 30 or 40 metres above the present shore. The old littoral shoreline of Lake Iroqouis is made up of clay and sand deposits. Its wave cut beaches, gravel bars and shoreline bluffs can still be discerned in various places below the escarpment.

2.3 Soil Formation

All forms of life on land depend on the productivity of the soil resource. It plays an organizing role in supporting and limiting human activity and is central to the function of natural systems. The areas of fairly deep till, sand and clay with gentle slopes and high content of limestone and clay are the parent materials from which the productive, arable soils of the Region were formed.

The quality and distribution of soils in the region is related to five factors; the mineral parent material, climate, vegetation, drainage and time. The principle components of soil are mineral particles, dead organic matter, soil atmosphere, water, and living organisms, (more than a billion individual life forms in a square metre).

There are many soil types in the region but three predominant subgroups; Orthic Brown Forest, Orthic Grey Brown Podzolic, and Brunisolic Grey Brown Podzolic. All these soils developed under forest cover on calcium based parent materials (i.e. limestone till). The types are distinguished mainly by the extent of the downward leaching of the substances resulting from the decay of organic matter. Other variations of the mixture of sand and clay and the wetness of the soil provide further distinctions that differentiate soil types.

2.4 Climate and vegetation

Climatic characteristics are key factors in determining vegetation and ultimately animal populations. The mean daily temperature, annual and monthly temperature, extreme low winter temperature, frost-free seasons and annual precipitation all act to create distinctive vegetation zones. Within these vegetation zones glacially derived landforms (soil texture and type, topography, slope aspect) "result in a mosaic of different vegetation types, rather than one uniform stand of trees" (Reid 1985, p. 33).

Hamilton-Wentworth is at the northern border of an area called "Carolinian Canada" where the native forest contains 70-100 species of trees compared to about 60 native species in forests of the more northerly "Great Lakes-St. Lawrence" forest region. This diversity is apparent in other plant groups, birds, and insects as well (Reid 1985). Falling in a transition zone between the hardwood-deciduous forest to the south and the mixed conifer-hardwood forests to the north, types of species are found here which usually belong in only one of the two forest zones.

Beginning about 10,000 years ago, after the retreat of the last glacier, mastodons and woolly mammoths roamed tundra and spruce forests in the area. After several climatic shifts and warmer periods hardwood species established themselves. Beginning about 1,000 A.D. native peoples carried on a form of slash-and-burn agriculture burning maple, oak, basswood, beech, hemlock and white pine forests to make way for temporarily-productive fields of maize, beans and squash.

In certain locations their agricultural activities gradually led to a situation where sun-tolerant species such as white pine, oak, and poplar began to grow at the expense of shade-tolerant trees such as beech and maple. As European settlers began to colonize the shores of Lake Ontario and the Niagara Peninsula the Region's forests were systematically and rapidly exploited. The timber trade was a primary focus of the area in the early 19th Century. Intensive wheat farming followed in the forest clearings created by timber cutting. By the turn of the century much of the Region's forests had been cut to make way for the rapidly expanding farm activity.

2.5 Physiography of Hamilton-Wentworth

The major physiographic features of the Region provided a basic supporting structure for the development of the forest, wetland stream and lake ecosystem that humans were later to take advantage of. Of the fifty-two minor physiographic regions of Southern Ontario, six are found in Hamilton-Wentworth; the Niagara Escarpment, Flamborough Plain, Horseshoe Moraine, Norfolk Sand Plain, Haldimand Clay Plain, and Iroquois Plain. Also at the head of the Dundas Valley is a kame moraine while the hilly valley itself is an old glacial spillway (see Figure "Physiography of Hamilton-Wentworth").

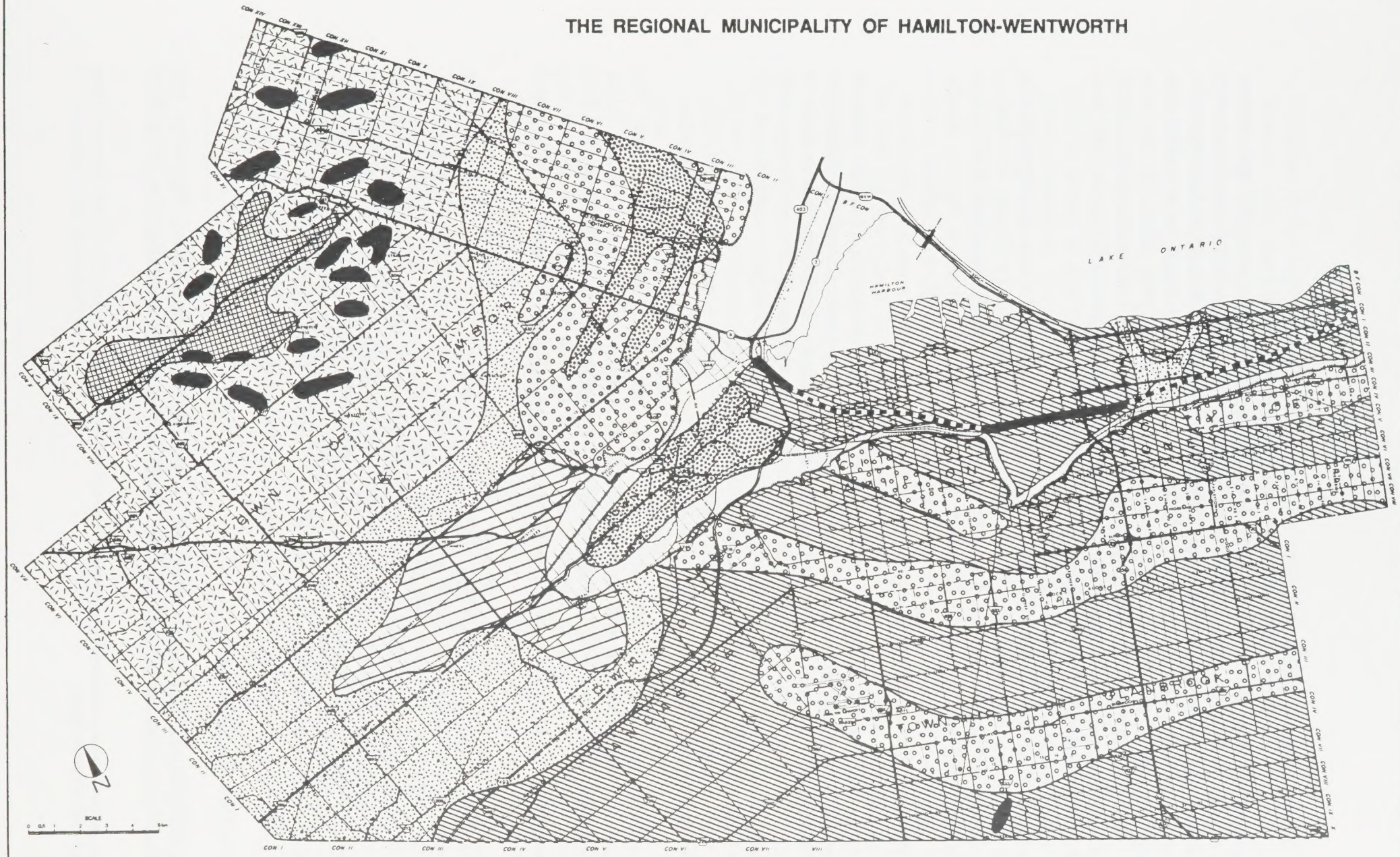
2.5.1 Escarpment

The Escarpment is the most prominent feature of the regional landscape. Vertical limestone cliffs of about 275 ft with steep slopes of fallen rock form a clear topographic break that is broken in two places by well-known features. The Red Hill Creek occupies a pre-glacial valley and the hilly Dundas Valley extends inland from Lake Ontario. The Valley rim is outlined by sharp, rock bluffs and the variable topography of the old spillway contains beds of sand and silty clay.

Spectacular waterfalls are among the pleasurable characteristics of the escarpment and many park areas have been set aside for public use. European settlements were often centred on the water-powered mills set-up along the creeks dropping from the escarpment.

The enormous escarpment and its associated collections of sand and gravel has provided much useful material. The limestone rock was mined for the lime used by the steel industry. Shale and clay is used for brick, tile and other ceramic products. The deposits of sand and gravel are excavated for use in construction.

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH



LEGEND

- ABANDONED SHORE BLUFFS
- ABANDONED BEACHES & BARS
- TILL MORAINE
- CLAY PLAIN
- DRUMLINS
- SPILLWAYS
- KAME MORRAINE
- SAND PLAIN
- LIMESTONE PLAIN
- SWAMPS & BOGS
- ESCARPMENT

PHYSIOGRAPHY OF HAMILTON-WENTWORTH

Planning and Development Department
Hamilton-Wentworth Region

2.5.2 Iroquois Plain

As mentioned above, the lowland bordering Lake Ontario was under the waters of Lake Iroquois during the Pleistocene. The soils are therefore sandy or clay intercut with gravelly bars. The agricultural advantages of this land between the escarpment and lake are primarily climatic. The growing season is extended due to the movement of air off the escarpment and the modifying effect of the lake water. This encouraged the development of an extensive horticultural and fruit industry which in the Region has been virtually supplanted by urban and industrial development east of Stoney Creek.

The gravel bar at the Desjardin high level bridge is an obvious legacy of Lake Iroquois while the old shoreline bluffs at Grimsby and Stoney Creek overlook a narrow shoreline plain. The old shoreline bluffs are cut by the Red Hill Creek which is drowned at its mouth forming wetland lagoons behind a barrier beach.

2.5.3 Horseshoe Moraine

The broad belt of moraines virtually circling south-western Ontario crosses Hamilton-Wentworth running in a south-west/north-east direction from the Sheffield/Rockton area to the border with Puslinch Township northwest of Freelton. The moraine is typified in the area by a system of old spillways with gravel and sand terraces and swampy floors. The area is lightly settled and not intensively cropped.

2.5.4 Flamborough Plain

The Flamborough Plain is an area of about 150 sq. miles bounded on the northwest by the moraine and on the south by sandy soils left in glacial lakes Wittlesey and Warren. The plain slopes to the south from 1,200 feet to 900 feet above sea level. The soil is shallow sand and gravel and in some places the limestone bedrock is visible at the surface. The soil is generally wet or stony and shallow.

Near Westover and surrounding Freelton a number of the long oval hills (drumlins) contain deeper beds of till and are more intensively cultivated. Generally however, swamps are plentiful and much of the area was left to wet woods or pasture by the farmers who were granted land concessions by the crown. The large Beverley Swamp and associated wetland complexes between the few scattered drumlins serve as reservoirs. The Beverley Swamp area is a headwater for both Spencer and Bronte creeks. Streams arising in the area run through three different watersheds, (Grand River, Cootes Paradise/Hamilton Harbour, Bronte Creek).

2.5.6 Norfolk Sand Plain

The Norfolk Sand Plain was deposited as a delta in glacial Lakes Wittlesey and Warren. Only a small portion of this large former delta running from Brantford

to Long Point and Port Stanley reaches into Hamilton-Wentworth. This sandy arm of the Norfolk Sand Plain juts into the Flamborough Plain, just barely crossing Highway Six north of Clappison's Corners near Millgrove. The area extending into Hamilton-Wentworth is bounded on the north by Highway 5 and on the south by Highway 2 and on the east by the escarpment and Highway 6 north.

Plentiful well-water may be found in the area due to good infiltration. This part of the sand plain is drained by Grindstone Creek. Once cleared for farming the soil is prone to erosion and extensive windbreak plantings and reforestation have been promoted. The soil supports crops typical of sandy soils, i.e. potatoes, fruits and vegetables.

2.5.7 Haldimand Clay Plain

This Haldimand Clay Plain lies between the Niagara Escarpment and Lake Erie. Although this area was all submerged by Lake Warren the glacial till is not all buried by clay. Just behind the escarpment in Stoney Creek is a second dolomite scarp face and then two morainic ridges running east/west. The ridges have influenced the drainage of the area so that 20 Mile Creek and the upper reaches of the Welland River drain to the east. Pockets of poorly drained depressions remain in the higher ground.

Near the escarpment the agriculture includes dairying, fruit and horticulture activity while proceeding to the south the land is of heavier clay, becomes increasingly poorly drained and is less fertile. Wet, slough forests characterize the area along the Haldimand-Norfolk, Hamilton-Wentworth border.

3. Existing Greenspace Features and Protection Activity [1]

Given this diverse and beautiful setting many agencies have engaged in some form of protective activity for natural areas. The title of this paper refers to natural areas and greenspaces. The use of the term natural areas can be misleading. The term refers to places that are large enough to warrant interest at the Regional scale and which have recognizable, relatively undisturbed plant communities and an associated animal community. They are often described as the 'remnant' or left-over places that did not experience, or have since recovered from the massive landscape changes that followed European settlement. Nature, however, is not limited to these places, in every eavestrough and vacant lot wild plant and animal species make their homes or forage for food.

Thus, greenspace is a category of landscapes including, remnant natural areas but

[1] This section is primarily based on material from the 1990 State of the Environment Report prepared by the Planning and Development Department.

also "trails, drainage areas, wetlands, rivers, creeks, forests, floodplains... steep slopes, parks, ball fields, vacant lots, recreation areas, bike paths, irrigation ditches, office parks, downtown plazas, and passive open space within subdivisions" (Henderson, 1990). Various words are often used interchangeably with "greenspace" such as open space, greenways, undeveloped areas and greenlands.

The Greater Toronto Area Greenlands Strategy includes these areas in its greenlands definition;

- green corridors or open space areas for walking, hiking, biking, or cross-country skiing
- significant natural, cultural and archaeological areas
- areas performing important natural functions (Kanter, 1990).

While the Region does not have a plan for an integrated greenspace system the primary elements of such a system exist. Presently, the parts of such a system are a mixture of privately owned, regulated or agency owned and managed areas. Many areas have multiple designations or regulations applied to them. A confusing array of names or policies for greenspace areas results from the objectives of various government agencies (see Figures).

For example these include; Official Plan designated Environmentally Sensitive Areas, Niagara Escarpment Commission natural areas, Conservation Authority lands and regulated areas, coldwater and migratory streams, Classes 1-3 Wetlands, provincially designated Areas of Natural and Scientific Interest, municipal trail systems and local parks.

Tree Protection By-Laws, the Ontario Heritage Act, the Woodlot Protection Act, Endangered Species Act, Federal Fisheries Act, and the Ontario Fisheries Plan are all part of the legislative framework acting to encourage proper management and discourage developments which negatively affects areas that serve as habitat for various species. (See Appendix "Legislation Pertinent to Protective Management in the Great Lakes")

3.1 Wetlands

Wetlands are now acknowledged to be a major force in flood control and watershed protection. They can absorb immense amounts of water during wet periods when run-off threatens to create flooding conditions along creeks, rivers and lakes. As water becomes more scarce and neighbouring areas become drier, wetlands slowly release water to adjacent areas or simply retain a relatively dependable reservoir. These are invaluable breeding and feeding grounds for numerous species of birds, animals and fish. The shallow slow-moving waters are instrumental in populating nearby land and lakes with birds, insects and amphibians.

The Ministry of Natural Resources has studied and classified wetlands in Ontario.

WETLANDS

Source : Ministry of Natural Rsources, Wetlands Inventory Report 1990

WETLANDS	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
CLASS 1	-	-	11,053	225	32	-	11,310
CLASS 2	-	-	-	91	-	-	91
CLASS 3	-	-	-	-	-	235	235
TOTAL (acres)	-	-	11,053	316	32	235	11,636

FOREST & WOODLOTS

Source : Ministry of Natural Resources, Forest Resource Inventory (1978 & 1984)

	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
FORESTS & WOODLOTS	9,494	(4) -	37,751	5,330	655	2,486	55,715

(4) No figures are available for Dundas since all areas are based on former township boundaries.

AREAS OF NATURAL & SCIENTIFIC INTERTEST

Source:Ministry of Natural Resources, Cambridge District, Resource Inventory (1986)

	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
EARTH SCIENCE	1,424	-	723	-	-	26	2,173
LIFE SCIENCE	578	427	4,838	225	-	139	6,208
TOTAL(acres)	(1) 1,424	427	5,561	225	-	165	7,803

NIAGARA ESCARPMENT COMMISSION

Source : Niagara Escarpment Commission (1990)

	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
NATURAL	2,451	419	1,519	-	1,062	821	6,272
PROTECTED	2,770	637	2,309	-	920	2,303	8,939
RURAL	932	-	5,032	-	-	247	6,211
TOTAL(acres)	6,153	1,056	8,860	-	1,982	3,371	21,422

ENVIRONMENTALLY SENSITIVE AREAS

Source : Ecologistics (1976)

	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
E.S.As	1009	(2) 7840	16746	714	2261	1486	30074

CONSERVATION AUTHORITY PARKS (3)

Source : Conservation Authority (1990)

	ANCASTER	DUNDAS	FLAMBOROUGH	GLANBROOK	HAMILTON	STONEY CR.	TOTAL(acres)
HAMILTON REGION C. A.	1953	372	1935	-	27	243	4529
NIAGARA PENINSULA C. A.	-	-	-	978	-	-	978
HALTON REGION C. A.	-	-	960	-	-	-	960
GRAND RIVER C. A.	-	-	-	-	-	-	-
TOTAL(acres)	1953	372	2895	978	27	243	6467

(1) All of the Life Science areas within Ancaster are within the Earth Science area.

(2) Dundas acreage includes all of Dundas Valley Royal Botanical Gardens.

(3) For community parks acreage refer to Area Municipal inventories.

The Province has issued a Draft Wetlands Policy Statement intended to ensure that municipalities protect Classes 1 - 3 from incompatible development. Once passed the Policy would require municipalities to identify and protect provincially significant wetlands in their official plans. Provincially significant wetlands would be placed in a restricted zoning category which permitted only wetlands and compatible land uses.

Presently the Ministry has published the Wetland Guidelines which addresses the issue of protecting wetlands but does not regulate municipal planning for land use in such areas. The strength of protective policies for wetlands is in the hands of the Region and area municipalities. Thus, the fate of wetlands from a land-use change perspective remains the responsibility of municipal governments. Many of the Hamilton-Wentworth's environmentally sensitive areas are wetlands. All eight provincially identified Class 1 and 2 Wetlands have been designated Regional ESAs. ESA designation does not absolutely prohibit development.

Large-scale drainage of wetlands for agricultural, residential and industrial purposes has led to a situation where only approximately one-fourth of Southern Ontario's original wetlands survive. Nevertheless, Hamilton-Wentworth, and in particular, Dundas and Flamborough, a sizeable area of wetlands remain. Flamborough alone retains much of its original wetlands, including the large Beverly Swamp.

The Royal Botanical Gardens owns about 2,000 acres surrounding Cootes Paradise, undertakes many conservation activities, maintains a trail system, and a variety of horticultural and native plant collections. The public recreational utility of such green spaces is reflected in the estimated 63,000 user days per year associated with the Royal Botanical Gardens. Cootes Paradise has sustained much ecological damage due to sedimentation problems from up-stream development and erosion. These problems have been made worse by the introduction of carp.

The pace of destruction of Hamilton-Wentworth's wetlands in the past two decades has slowed considerably compared to the second half of the 19th Century and the first half of the 20th Century. In the period, 1965-1982 a net loss of only 50 acres of wetlands was recorded as many acres of marginal agricultural land were allowed to return to a more natural state.

3.2 Trees and Wooded Areas

Estimates of the acreage of forested land in the Region range from 22,000 to 35,000 depending on how the agencies classify forested property. When woodlots are included estimates of the treed area grow considerably. The majority of heavily forested land is located in the western half of the Region, primarily in Flamborough but also in Dundas and Ancaster. More than 15,000 acres of forested land remain in Flamborough, where there are numerous Woodlot Improvement Act and Water Conservation-Forest policy areas. This area municipality is by far the most important source of wood products in the Region.

However, the rate at which these forested areas are being diminished is cause for concern. According to assessment records, between 1982 and 1987, the Region experienced a 1,740 acre reduction in the area of forested land. The drop from 35,855 acres in 1982 to 34,144 acres in 1987 represented a 4.85 percent reduction of the 1982 acreage.

Direct activities to save the Region's woodlots and forests have been undertaken by the Conservation Authorities, the Ministry of Natural Resources (MNR) and the Ontario Heritage Stewardship Program. As of 1990, the Natural Heritage Stewardship Program had contacted 180 landowners in Carolinian Canada sites within the Region. One hundred private stewardship agreements were reached covering some 1,540 acres of land. The Conservation Authorities have been able to combat the effects of certain diseases or insect infestations. Some area municipalities have instituted Tree Protection by-law even though such by-laws have only limited effect.

The number of plantings under the Woodlands Improvement Act has been relatively strong in recent years. In 1990 109,100 new trees were planted, while in 1989 and 1988 the number of new trees planted was 57,900 and 65,400, respectively. The Ministry of Natural Resources is limited in its choice of reforestation species by the quality of the soil on reforestation sites and is often unable to produce the intended results. Ministry plantations are often pine and cannot immediately recreate the complex mix of deciduous-coniferous habitat in older forests.

3.3 Environmentally Sensitive Areas

The Hamilton-Wentworth Official Plan contains a section that designates thirty-seven areas in the Region of varying size as Environmentally Sensitive Areas. (ESAs) The ESAs comprise some 30,000 acres and approximately 10 percent of the Region's land area. Most of these areas are concentrated in the western and central parts of the Region i.e., in or near the Dundas Valley and the central-western portion of Flamborough.

An ESA designation in the Official Plan does not prohibit development in the areas. Any proposed development requiring approval must be accompanied by a study outlining the impacts of the development on the environmentally sensitive attributes of the area or receive a waiver from the study requirement from the local and Regional Council.

Development in the designated Environmentally Sensitive Areas (ESAs) is an issue in Ancaster, Dundas and Flamborough, where new residential construction in the Dundas Valley and along the Escarpment is threatening many pockets of unique physical and biological attributes. Another noteworthy area is Red Hill Creek/King's Forest where the proposed freeway has focussed much attention.

The Official Plan policies on ESAs have been incorporated into the development process. The process can be viewed as a success if the goal is to allow development within environmentally sensitive areas in a form that minimizes damage to the local environment that would otherwise occur in standard development situations. On the other hand, if the goal is that these environmentally sensitive areas be largely preserved in their natural state because of their unique importance within the region, then the existing process will likely be unsuccessful over time.

The success or failure of Regional ESA policies is hard to judge due to a lack of information about the areas. Fifty-nine development proposals were subjected to ESA Policy requirements in the period 1981-1991. Forty-nine received a waiver from the requirement to submit an Environmental Impact Statement. Thirty-five of the fifty-nine proposals were in the Dundas Valley. There are a variety of program suggestions as well as development control policies in the Official Plan. To date, the program type actions such as land acquisition, land-owner contact have not been thoroughly implemented.

3.4 Areas of Natural and Scientific Interest (ANSI's)

ANSIs are not to be confused with the ESA designation. ANSIs are not given any special protection through Provincial legislation. The Ministry of Natural Resources has designated ANSI's throughout the Province, based on either the unique or important biological or physical characteristics of the areas in question. The principle of representation for earth science sites is to protect examples of features which illustrate Ontario's earth science history. Designation as a life science representation is given for areas that are noted for distinctive plant and animal communities.
In Hamilton-Wentworth there are seven designated Areas of Natural and Scientific Interest noted for earth science attributes: Devil's Punch Bowl in Stoney Creek, Dundas Valley in Ancaster, Freelton Esker in Flamborough, King City Quarry in Flamborough, Spencers Creek Bedrock Gorge in Flamborough, the Westover Area in Flamborough, and Grindstone Creek in Flamborough.

There are six designated Areas of Natural and Scientific Interest in the Region noted for life science attributes: Beverly Swamp in Flamborough, Cootes Paradise Drowned Valley in Dundas, Dundas Valley Forests in Ancaster, Niagara Section Escarpment in Stoney Creek, Sinclairville Meander Basin in Glanbrook, and Spencers Gorge Escarpment Valley in Flamborough. Only the Sinclairville Meander Basin and King City Quarry in Flamborough are not portions of ESAs in the Official Plan.

3.5 Niagara Escarpment Plan

Approved in 1985 the Niagara Escarpment Plan seeks to conserve significant natural areas and culturally important sites while providing direction for planning within the area covered by the Niagara Escarpment Development Act. The Plan is currently under review.

The Niagara Escarpment Commission administers a development permit system, comments on, and monitors activities within the Escarpment Plan Area. Any development that occurs within the area of the Niagara Escarpment Plan is subject to a development permit from the Commission. In Hamilton-Wentworth the Plan Area covers the cliff face, large areas of land within the Dundas Valley, and portions of Flamborough near the border with Halton. The Niagara Escarpment Commission has designated 6,273 acres "natural" within the Plan area in the Region.

A key recreational feature of the escarpment is the Bruce Trail and its associated feeders trails. The Bruce Trail Association has recently published its management plan for the improvement and enhancement of the trail. In February 1990 the Niagara Escarpment was named a Biosphere Reserve by the Unesco, Man and the Biosphere Programme.

Parkway Belt System

The Parkway Belt West Plan incorporates areas along the lip of the Escarpment near Waterdown and portions of the Dundas Valley surrounding Cootes Paradise. Essentially these are lands which are part of the 403 transportation corridor, utility rights of way, and areas controlled by the Royal Botanical Gardens. Passed by Cabinet in 1978 the objectives of the System are to separate and define the boundaries of urban areas, provide a land reserve for future transportation or utilities corridors and provide a system of linked open space and recreational facilities. The Parkway Plan is considered part of the Regional Official Plan. For consistency purposes the Provincial Government has made a commitment that the portions of the Escarpment covered by the Parkway Belt Plan are to be incorporated into the Niagara Escarpment Plan.

3.6 Conservation Authority Lands and Regulations

Conservation Authorities (CAs) have a broad mandate under Section 20 of the Conservation Authorities Act. They are funded jointly by the Province and municipal governments. The Region of Hamilton-Wentworth is divided into four separate watersheds which are under the jurisdictions of the Halton Region, Hamilton Region, Grand River, and Niagara Peninsula Conservation Authorities. Within its jurisdiction each Authority is responsible for the establishment and implementation of programs designed to further the conservation, restoration, development and management of natural resources. The CAs establish flood and fill lines. The Conservation Authorities are responsible for acquiring land under the Niagara Escarpment Plan.

The Conservation Authority's main mandate is to manage local water and related land resources in accordance with the Conservation Authorities Act, however, in response to both local and provincial needs, the Authorities have become involved in numerous ancillary activities leading to a number of important resource management benefits. These include, fish and wildlife, outdoor recreation, tree plantings, conservation education, heritage conservation, waterfront development, wetlands protection, and Environmentally Sensitive Area protection.

The Conservation Authorities are a key institutional actor in the land use planning process since they exercise considerable authority over the condition of water resources, control of drainage, stormwater sewer routes, and flood mitigation measures. Most developments of any size will have some impact on nearby water flows. The Conservation Authority's views on the necessity for mitigating measures in specific developments are often made conditions of development approval. Thus, the Authorities must be satisfied that the landowner's development plans will not adversely affect drainage patterns or endanger local stream quality.

3.7 Parks and Municipal Land

Many of the Area Municipalities have made commitments to park standards within urban areas, usually expressed in acres per thousand population. These commitments generally range from 5 to 10 acres per thousand. A generally accepted urban planning standard is 6.25 acres of developed open space per thousand people (Krohe 1990). Therefore, some districts are considered over-serviced and others under-serviced and the local parks departments set acquisition targets accordingly. Achieving these relatively recent targets is more difficult in old under-serviced urban areas.

The last comprehensive open space inventory for the Region was done in 1975 (Planning and Development Department 1976). More recently a number of area municipalities have completed their own park or facilities inventories. Generally these establish a hierarchy of park types; neighbourhood parks, community parks, district parks and special parks or areas. Nevertheless, the categories of open space or park types in these studies are not identical and comparisons can be awkward.

It is also getting harder to define parks by using the old standards;

> Increasingly, public park and recreation space is seen in a wider context, as merely one part of a complex network of spaces of different types that together comprise a city's recreation system (Krohe 1990, p. 13).

Most municipalities in the Region leave the management of natural areas, including forests, to the Conservation Authorities. Historically the Parks and Recreation or Public Works Departments have generally been expected to provide soccer fields, baseball diamonds or floral displays etc... Recently, as in Stoney Creek, Parks Departments have begun to use more native species in their plantings.

The adoption of such practices will likely be a more common feature of parks planning as well as public works in general. For instance, storm water management channels and retention ponds can be designed in a more natural way so as to protect or promote fish habitat and provide naturalistic corridors to link recreational or natural areas. These are more sustainable practices since they more easily respect the function of the natural ecosystem.

4. The Ecosystem Perspective

An ecosystem is the system created by the interacting assemblage of animals and plants within their physical environment. The ecosystem idea is simply that everything is connected to everything else. In all ecosystems there are several familiar flows of energy and nutrients. Stemming from soil, rain and solar energy are; the basic **food cycle** consisting of green plants, herbivores, carnivores and decomposing organisms; the **oxygen and carbon cycles** based on photosynthesis and respiration; the **hydrologic cycle** and the **nitrogen cycle**. The system idea says that a change in one element will necessitate a change or adjustment in one or more other elements, i.e. a state of dynamic equilibrium.

The Interim Crombie Commission Report "Watershed" and Hamilton Harbour Remedial Action Plan has used the ecosystem perspective. To develop a sustainable vision or goals for greenspace in the Region an "ecosystem perspective" is necessary as a way of understanding the functions of specific land areas or plant communities within the broader landscape. The ecosystem perspective is necessary to understand which areas of land provide wildlife corridors and headwaters for streams. Understanding the relationships between different elements of the ecosystem (climate, soils, plants, animals etc...) is also necessary to assess the cumulative impacts of various developments. The ecosystem perspective provides the basis for evaluating the relative importance of different landscape features but not necessarily for setting specific protection objectives.

Preserving the productive potential of the land means preserving the ecosystem structure with which it is associated, i.e landform, soils, vegetation and watercycle. If we preserve ecosystem structure we will also be preserving habitat for animals other than ourselves. The first step towards such an approach is understanding ecosystems.

4.1 The Ecosystem Perspective and Urban Areas

The ecosystem perspective leads to a more thorough understanding of ecological processes in urban settings;

> The urban forest-- composed of thousands upon thousands of trees in ravines, parks and residential streets, back alleys and empty lots--plays a critical role in the city's environment. It takes in prodigious amounts of carbon dioxide (the main culprit in global warming) and gives off the oxygen on which human and animal life depends. At no small cost to themselves, trees filter the city air of carbon monoxide, airborne lead, sulfur dioxide, hydrocarbons and other chemicals. Because a mature tree pulls up hundreds of gallons of water each day through its roots and releases it in microscopic droplets through pores in its leaves, it produces moister air as well. Shelter and windbreak in winter, in summer a tree can cast shade that could reduce air conditioning bills by as much as 20 per cent (Ohlendorf-Moffat, "September in Summer", Toronto Magazine., p. 30.).

Thorough though landscape change may be, the diversity of species on inner-city vacant lands can be quite high;

> For example, a block of land on Lutzowplatz in Berlin's Tiergarten harbours 164 flowering plants and at least 250 arthropod species...the maintained lawns and shrubs of the adjacent (park) contain only a quarter of these insects on a comparable area of land (Horbert et al 1980, p. 269).

Evidently the preservation or enhancement of the ecosystem is not necessarily confined to large areas. This perspective leads to a different kind of approach to urban greenery. Urban forestry and the naturalization of some public spaces is based on the notion of multiple-use. Given this multi-objective framework the use of parkland for only ornamental horticultural or active recreational is a waste of resources and represents lost opportunities for a more diverse landscape (Hough 1984).

The developing experience in this field can be narrowed down to a few central ideas:

1. Planting of a diversity of native species.
2. Low interference; i.e. minimal management and biological pest control.
3. Selective harvesting.
4. Habitat development and rehabilitation; i.e. landscaping for wildlife.
5. Promotion or allowance of a variety of human uses, (multiple-use).

The changing of management practices in public open space will require some retraining of professionals and a shift in public attitudes so that low-maintenance or the naturalization of park space is not perceived as messy and unattractive. This shift in professional approach and public perceptions are well under way but may still be promoted by education and information programs (Gordon 1990).

4.2 Values and Utilisation of Ecosystem Processes

Modern urban society often appears to be separate from "nature". Aside from agriculture, forestry and fisheries it is easy to think of the production of necessities and luxuries as a product solely of hard human labour and technical expertise. Yet, humanity has always relied on the ecosystem for sustenance and survival. Our use of scientific data and managerial know-how in the industrial age has generally focused on the increasingly efficient utilization of more or less fixed stocks of energy and resources that took the global ecosystem hundreds of millions of year to create.

Evidence of depleting topsoils, forests, fresh water and cheap non-renewable energy sources suggests instead that we should be focusing our technological efforts on managing renewable sources of matter and energy. In the extremely long-term, the thermodynamic principle of entropy means that matter and energy cannot be continuously recycled. However, the time-span for this depletion of available energy is so vast that its significance can be boiled down to the idea that more sustainable models and theories of environmental management should emphasize management of process within a long-term perspective. Such an approach would recognize;

1. that resources are not infinite (although for humans solar energy might as well be),

2. that ecosystems are capable of withstanding only limited interference without negative consequences and

3. that the basic structure and genetic diversity in ecosystems is irreplaceable.

Our society relies on ecological processes for a wide variety of important services and resources. More specifically, the series of potential economic, social and ecological values and function includes;

* Habitat for wildlife, rare and endangered plant and animal species, a pool of genetic resources.

* Production of oxygen by vegetation, filtration of air by vegetation, control of wind erosion, microclimatic modification.

* Control of water erosion (slope stabilization), retention of flood waters, recharge of groundwater, filtration of water, protection of discharge areas (springs).

* Primary production of wood, fish, wild fruits and foods.

* Aesthetic value, historic and cultural value, passive and active recreation, opportunities for education and research, sensory diversity.

* Buffers for incompatible uses, noise attenuation, visual screening, linkages and corridors between other open spaces.

(Dorney 1977, Lang and Armour 1980)

The analysis of different land units has led to a general understanding of the various functions performed by the ecosystem. These can be grouped under the following headings;

1. Production functions: the supply of matter and energy from natural resources.
2. Carrier functions: provision of space and surface.
3. Information functions: assessment of natural features and processes provides signals and indicators (also psychological relief.)
4. Regulation functions: purification and stabilization, e.g. filtration of cosmic rays, flood control. (Van der Maarel)

4.3 Disruptive Human Activity and Impacts

People change the functioning of ecosystems through the variety of uses they make of land. Economic, population and attitudinal trends are reflected in land use patterns as people choose where and how to live. Each person's private decision about changing the use of a given piece of land is based on the value or importance that person places on the subsequent use versus the existing use. However, while the effects of such decisions may not be considered significant by the individual landowner, the incremental and cumulative effects on the ecosystem of many such decisions may be substantial.

For example, urbanization is known to have many varied impacts such as, the loss of food-producing soils, increased localized temperatures, increased surface runoff, increases in contaminants in runoff, loss of habitat, while a reduction in vegetation decreases photosynthetic production of oxygen.

Human activities can disrupt the numerous processes that we depend on for clean air, potable water, and outdoor recreation. The activities range from minor disruptions such as trail impacts in a natural area to major disruptions such as the construction of new buildings or roads over groundwater recharge areas. Clearly, the exercise of individual property rights and the communal interest can conflict.

Some of the most obvious forms of human impacts are listed below;

Air pollution; ground level ozone, acid rain and deposition of heavy metals etc... create stress on vegetation and animals.

The overuse of **watercourses/waterbodies as sinks for waste**; sewage (chemicals and biological waste), direct industrial discharge, sediment-laden stormwater, fertilizer run-off from agricultural fields has created such problems as excessive nutrients in ponds and lakes and bio-accumulation of persistent toxics in the food chain. These impacts and changes in the clarity and temperature of water have changed the species composition and severely reduced the diversity and health of water ecosystems. Nitrate and nitrite has contaminated groundwater in many areas and toxic contamination of groundwater is a growing concern.

Alteration of watercourses and natural drainage patterns occurs on a small scale when home owners or industrial enterprises try to ensure that flooding does not affect their own particular properties. Large-scale projects are usually undertaken to avoid flooding and erosion problems. The artificial drainage of agricultural land is common all over Southern Ontario.

The unintended effects of these activities can include; erosion, sedimentation, loss of groundwater recharge areas and destruction of natural wetland habitat, increases in sealed surfaces leading to higher flows and velocity of run-off water, and short bursts of highly-contaminated water (motor oils, gasoline, salt etc..) washed down from urban areas into streams, wetlands and lakes. In Hamilton-Wentworth, these problems have contributed to bacteria contamination and suspended solids loadings into Cootes Paradise, Hamilton Harbour, and areas of Lake Ontario adjacent to streams and storm sewer outlets.

Occupation of land by man-made features and **habitat fragmentation** results from the progressive increase in land area occupied by buildings, roads, airstrips, railways, pipelines etc... The destruction of habitat is the main threat to rare and endangered species.

Many natural community associations are forever altered by changes in the size of available habitat. An unfortunate result of the preservation of only isolated and separated "islands of green" in the midst of urban development is that many species are unable to migrate, mate and feed in a way that resembles their original requirements. The piecemeal protection of natural areas can reduce the viability of certain species that need deep forest even while increasing the habitat for species that prefer clearings, or edge habitat.

Habitat alienation results from repeated or continuous disturbances that make a habitat unpleasant or uninhabitable even though there may have been no physical reduction in size. Noise pollution, excessive vibration or turbidity in water, and air pollution are all examples of byproducts of human activity that can lead to wildlife or fish altering their behaviour in a dramatic way. Birds and wildlife may abandon previously occupied habitats, or stop mating and reproducing because of disturbance to their environments. In some cases, the physical environment (i.e. waterbody, forest or wetland) may not have been visibly altered but the ecosystem may have been damaged substantially.

Introduction of non-native species can include exotic trees, alien species of fish like carp, other species (zebra mussels) or plants such as purple loosestrife that replace the native bulrush communities. In good situations, local wildlife and vegetation adapt readily to the introduction of new species. In other situations the adjustments can transform the balance between species, crowding out or replacing the niches and food sources of existing flora and fauna.

Renewable resource harvesting like tree-cutting can conflict with the protection of rare or endangered species and increase erosion. The MNR is reviewing their guidelines on wildlife management and fisheries management. The management approach is becoming more sensitive to the need to protect not just the quantity of the resource but now also the quality of the resource.

4.3.1 Cumulative Impacts on Animal and Plant Life

A diversity of species is an indicator of a healthy functioning ecosystem and a good indicator of potential impacts on human health and well-being. A substantial variety of species is found in the Region. Phenomena such as urban growth and the cumulative effects of changes in land use continue to threaten the existence of some species, but the extent and the immediacy of the threat is not well understood because of the inadequacy of information.

The Ministry of Natural Resources maintains a list of rare and significant fauna in the Region. On this list are 59 breeding birds, 22 reptiles and amphibians, and 16 mammals (Ministry of Natural Resources, 1986). Despite these efforts at cataloguing species Hamilton-Wentworth lacks a comprehensive inventory of flora and fauna found in the Region.

The most comprehensive study is a 1976 study commissioned by the four conservation authorities and carried out by Ecologistics consultants. Since that time only site-specific studies have been undertaken for development proposals in defined natural areas, or for Environmental Assessments of major public projects such as road construction or pipeline development. Breeding-bird surveys, reptile and amphibian inventories and the like have yet to be consolidated into a comprehensive document or data base.

The Hamilton Naturalist Club is currently managing a Natural Areas Inventory with support from the Region, Ministry of Environment, Ministry of Natural Resources and numerous individual and private donations. The inventory will collect data on species in natural areas within the Region. This is essential baseline information if the impacts of development are to be successfully monitored or if a proper evaluation of natural area protection is to accomplished.

The assessment of cumulative effects is based on principles of ecosystem stability and resilience. Ecosystems can only sustain a certain level of disturbance before major changes occur in the function of the ecosystem. These levels are called thresholds. Cumulative effects assessment tries to determine the point at which additional disturbances will cause negative ecosystem changes (Hubbard 1990). It would therefore provide the basis for pro-active or preventative planning.

The assessment of cumulative effects is important because the evaluation of developments on a project by project basis (Environmental Impact Assessment) has generally failed to assess the ability of a regionally defined ecosystem to sustain damage (Hubbard 1990). A key component for this type of assessment will be the development of a regional environmental data base. If this knowledge is to be applied to the development approval process significant inter-agency co-ordination, shared goals and multi-disciplinary team-work is necessary.

5. Sustainable Development Values

The rationales advanced for protecting or enhancing natural areas and for providing greenspace for recreation or education cover a broad range of spiritual arguments, utilitarian values and quality of life concerns. These lead to moral and ethical prescriptions for the way society should behave in regard to the natural world.

Many of the changes we make to the land resource to accommodate our present styles of living are irreversible and future generations are not here to join the debate about appropriate use. Sustainable development carries many different meanings for people but one fundamental idea is that any development that takes place must not reduce the ability of future generations to meet their own needs.

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

This widely used definition of sustainable development is centred on human needs. It assumes that society can distinguish between needs and wants and somehow also predict the needs of future generations. The ethical direction is that the use of the Region's or earth's resources should be limited to the extent that we do not reduce the stock of available resources below some minimum level that will be needed by future generations. The word resource itself implies eventual or potential exploitation by humans. Also, to the extent that humans need psychological relief from urban life, access to undeveloped lands requires a balance between paved and vegetated areas.

Sustaining economic activity without reducing the productive potential of ecosystems has been described as "living on the interest, not on the capital". Outlining a limits to growth approach on this basis would be both a scientific and social challenge. Given constantly changing technology, and depending on the geographic boundaries that are used, "carrying capacity" or "maximum sustainable yield" of a given area is difficult to define. Nor are our social institutions presently set-up to control consumptive activity or local economic behaviour so that the real but undefined limits set by the renewable, productive potential of local ecosystems are not breached.

This is not to say that objectives cannot be developed but they are now originally based on social values not scientifically determined limits. Objective research may determine which areas are more or less significant or determine the cause of a degradation problem but the commitment to preservation or protection is a social or political commitment.

The main challenge is to develop a regional strategy to identify and achieve adequate long-term protection of certain important parts of the landscape as well as providing equitable access to green or natural areas. Absolute objectives for this strategy are difficult to develop from broad ideas like sustainable development. For instance, how do we weigh in the balance the present "need" (as opposed to demand, want or luxury) of residential development in a woodlot compared to the needs of future generations.

5.1 Values and Goals for Greenspace Protection

The World Conservation Strategy identifies three goals of resource conservation;

1. To maintain essential ecological processes and life-support systems.
2. To preserve genetic diversity.
3. To ensure the sustainable utilization of species and ecosystems.

Canada endorsed these goals in 1981 (Geomatics, 1990). Natural areas and greenspace lands are integral to the achievement of these goals. Containing habitat and species they provide a foundation for maintaining genetic diversity. They also contribute to the maintenance of essential ecological processes (eg. oxygen production) (Region of Niagara, 1989).

Two basic values imbedded in sustainable development ideas are thought to be relevant to natural areas:

> Intergenerational equity: defined as leaving the ecosystem in no worse condition than it was received from previous generations
>
> Conserving options: defined as conserving the diversity of the natural resource base (Crombie Commission, 1990).

The Halton Official Plan Review document "Land Stewardship and Healthy Communities" which proposes the fundamental value of "preserving landform permanence" also advances the supporting principle of land stewardship.

> ...the ownership rights of land are not absolute...This is not meant as a denial of property rights, but an affirmation of social responsibility. The duration over which a particular individual has titles to a piece of real property is but a fleeting moment in the history of the land. Individual property owners shall be encouraged to consider themselves as stewards of the land... To be stewards, we have to develop a renewed respect for the land, knowing that the quality of our natural environment is as much a part of our quality of life as our jobs, wealth and health. The extent to which an individual realizes the economic benefit of a land use change should be balanced by the community's desire in preserving the environment or certain forms in the landscape (Halton Region, 1991).

The call for the development of a land ethic to guide the decisions people make about land has been made by numerous writers;

> The land ethic simply enlarges the boundaries of community to include soils, water, plants and animals, or collectively: the land...quit thinking about land-use as solely an economic problem. Examine each question in terms of what is ethically or aesthetically right as

> well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community... (Aldo Leopold quoted in Beatley 1989).

Therefore, the philosophical foundations for the rights and duties human beings have to themselves and to other animals and plants is generally a mixture of ecocentric and anthropocentric values.

Ecocentric arguments are based on beliefs that organisms, species and ecosystems have value in and of themselves. Anthropocentric views are based on enlightened self-interest, where ecosystems and plants are seen to have value because of human wants or needs.

Perhaps a distinction should be made between preservation goals and conservation goals. Preservation directed activities might better fulfil ecocentric values since they often include a long-term perspective of protecting species in perpetuity. Conservation activities might better fulfil anthropocentric values because conservation implies saving for future use.

Geomatics Consultants have outlined a relationship between values, objectives and criteria for protecting natural areas. They suggest one root value with several corollary values as a guide for the development of objectives;

> A recognition of kinship with other living organisms and an understanding that we are part of our natural environment and are therefore intimately bonded to it.
>
> i) A desire to retain examples of the natural environment that are familiar to us and give us a sense of roots or belonging.
>
> ii) Respect for future generations and a desire to maintain an environment that will sustain them.
>
> iii) A desire to maintain examples of the natural environment that can be used to foster a better understanding of our relationship between ourselves and our environment (Geomatics 1990).

5.2 Alternative Strategies for Greenspace Protection

The National Capital Commission in their document How to Promote, Demonstrate and Implement Sustainable Development in the N.C.C. Greenbelt and Beyond proposed the following general strategies for their Greenbelt system;

> 1) **maintenance of essential ecological processes** will require a strategy which recognizes the part which all ecosystems play in the management of a sustainable society, e.g. watersheds, wildlife corridors, ravine corridors, forest reserves, wetlands ...

2) **maintenance of biological diversity/resources at sustainable levels** will require habitat protection to at least maintain minimum viable populations of species and any resource extraction (forestry, water taking) must be done on a sustained yield basis and not impede the capacity of hydrological cycles (Ernst, 1990).

If effective action is to follow these kinds of statements need to be transformed into clear criteria. (See Appendix Environmentally Sensitive Areas)

> Greenlands provide a variety of functions and serve an array of uses... However, when terms such as protect, preserve, conserve, rehabilitate or enhance are used, it must be made clear as to exactly what is being said. The questions to be asked are: "what purpose is the greenland to serve", and then in achieving that purpose, "what action, if any, is required now and over time" (Kanter Report, 1990).

A workshop by the Environment and Ecological Advisory Committees of various Regions in Ontario led to the development of three general purposes and related strategies;

A) To identify and protect significant natural areas.

Strategy: Mapping and research of identified areas.
Tracking development trends.
Research benefits of defined areas.
Protection must include various tools:

* effective planning designations,
* public support for protection,
* cooperative efforts and trade-offs with developers,
* direct purchase
* restrictive covenants on deeds
* tax deductions for donations and land trusts.

B) To maintain healthy and diverse wildlife populations.

Strategy: When development must occur, the concept of net environmental gain should be followed, with improved environmental quality maintained into the future. Areas should be monitored.
Fines for violation of regulations should fit the crime of future theft. Rehabilitation to enhance and rebuild wildlife corridors should be pursued through subsidies and landowner contact.

C) To encourage activities based on natural ecosystems.

Strategy: Some areas should have no activity and the land should be viewed as a bank for future generations. Strong policies are required for dedicating parklands and setting aside natural areas. Hiking trails, bicycle paths and passive activities should be promoted where appropriate (Region of Niagara, 1989).

The identification of areas with poor access to greenspace can lead to programs which address the equity values of sustainable development. Opportunities for access by all members of the community can be created by the purposeful development of networks through built-up neighbourhoods and through the creation or rehabilitation of greenspace areas in other districts. Such an approach would require good communication and integration of objectives between municipalities, Conservation Authorities and community groups.

The proposed vision of the Hamilton Conservation Authority (Vanderbrug 1990), the 1984 Dundas Leisure Master Plan (Hough and Stansbury 1984), and the Town of Flamborough Recreation, Parks and Facilities Master Plan (Cumming Cockburn Limited 1991) all explicitly endorse the protection of sensitive sites within an open space concept of establishing links and trail systems.

Implementing these separate visions will require the sustained commitment of many agencies and levels of government since many of the areas cross municipal and watershed boundaries within the Region. Such a commitment must stem from shared and clearly established goals. A "greenspace system" for the Region would identify and secure for the future an accessible, linked network of streams, protected natural areas, and a variety of diverse landscapes for recreation. This might include the following goals and types of activity;

Municipal Institutional Goals:

1. Develop regional and district habitat surveys and species databanks.
2. Protect important wildlife areas.
3. Develop networks of green space corridors throughout built-up areas.
4. Identify areas with poor access to semi-natural green spaces and adopt schemes to create habitat in deficient areas.
5. Promote nature in major improvement schemes.
6. Establish links with local communities and conservation groups.
7. Integrate the above into a coherent strategy.

Related Municipal Institutional Tasks:

1. Review existing procedures to identify opportunities for low-cost adjustments.
2. Examine organisational structures, responsibilities and personnel capacities.
3. Build links with other organisations.
4. Use resources effectively.

5. Protect important wildlife resources.
6. Review management procedures for municipally owned property.
7. Take account of basic ecological principles. (Simmons and Barker 1988)

5.3 Range of Techniques

Much of the conservation literature suggests a two-pronged approach to wildlife habitat conservation. The various avenues for acquisition and/or legislative designation of parks and protected areas by public agencies is considered insufficient because large areas of the landscape belong to private individuals. The second prong consists of broad, comprehensive stewardship programs on privately owned lands and has generally been under-utilized in Canada. (Trombetti and Cox 1990). Nevertheless, in Ontario, the Natural Heritage League and Ontario Heritage Foundation has been actively engaged in applying this second group of techniques.

In the context of a coherent, purposeful strategy a broad mixture of acquisition, land use planning controls, stewardship initiatives and corporate responsibility would be possible with different agencies or community groups taking responsibility for the parts of the program they were most able to carry out. Since the acquisition of all greenspace lands would be prohibitively expensive this mixed, partnership approach allows for the flexible use of the most appropriate measure in different circumstances.

5.3.1 Land Use Planning Controls

A variety of regulatory mechanisms or procedures could be utilized for the protection or enhancement of greenspace. Their use and value has been described by (among others) Butler Group Consultants for the Toronto Area Greenlands Strategy. The tools available to the Regional and municipal governments include;

* Official Plans (Environmentally Sensitive Area Designation/Cluster Housing in Rural Areas)
* Zoning By-Laws/Zoning Orders
* Plan of Subdivision/Severance Approvals
* Site Plan Control By-Laws
* Interim Control By-Laws
* Increased Density By-Laws (Bonus Zoning/Density Transfers Use of Density Coverage)
* Holding Zones
* Dual Zoning of A Single Property
* Setbacks/Development Envelopes

The role of approval authorities, particularly Committees of Adjustment and Land Division Committees, in the implementation and of official plan policies and zoning by-laws can be supplemented by citizen and expert Environmental and Ecological Advisory Committees (EEACs) who can provide consist interpretations and advice.

Other mechanisms are available at the Provincial level, such as;

* Expression of Provincial Interest,
* Policy Statements,
* Minister's Zoning Orders,
* Provincial Plans/Development Permits (Butler Group 1990).

5.3.2 Non-Statutory Tools/Stewardship

Non-statutory tools and programs are an increasingly significant component of natural areas protection, and include;

* Notification/education of the landowner of the ecological significance on the property.
* Registration or listing of sites with or without legal protection.
* Management Agreements (Stewardship Agreements) where the landowner agrees not to destroy habitat.
* Rights of first refusal on sale are given to conservation agency by the landowner.
* Purchase and sale back, where the government agency purchases a property, places restrictions on title and then sells the land back to the public.
* Restrictive covenants can be placed on land by owners with the help of a conservation organization.
* Conservation easements, where partial rights to a property are purchased by a conservation organization.
* Dedication, where the landowner donates property to a public agency or conservation agency (Smith 1987, Trombetti and Cox 1990, Hoose).

6. Conclusion

The Region of Hamilton-Wentworth is blessed with a diverse variety of natural and semi-natural landscape features. The concept of greenspace creates a way of understanding each particular landscape unit from the point of view of its links to the broader ecological and social context. In parallel there is a growing body of literature which describes the tools and techniques in the present legal and planning system which could be used to secure greenspace.

There is evidence in society of a growing sense of the importance of preserving greenspace. This is reinforced by the growing willingness by many agencies and groups to examine the role their activities play within an ecosystem perspective. Furthermore, many local groups and agencies have goals and visions for the use of greenspace which mesh well into the concept of sustainable development. In fact, to the extent that many of these ideas have gone beyond human need and

expressed the idea that animals and plants have value in and of themselves, the values are even more ecologically centred than the common definition of sustainable development.

These are positive trends since they carry forward many sustainable development ideas concerning the preservation of resources. Following from several sustainable development goals a commitment to a comprehensive strategy could be created through an integrated Regional program for preserving and providing access to identified features. Nevertheless, the development of appropriate long-term management plans based on cumulative effects assessment must rely on future improvements in our knowledge of ecological systems in the Region.

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APPENDIX

Environmentally Sensitive Areas

The Environmentally Sensitive Areas now included in the Region's Official Plan were chosen as the result of a selection process undertaken in 1975 and 1976. A basically similar but more particular set of criteria will be used in the 1991 Natural Areas Inventory Project which will determine if new areas deserve designation.

Different parts of the Region noted for their vegetation, topography, wildlife, size, and uniqueness in Hamilton-Wentworth were analysed for their physical and biological attributes. They were then given a rating of A, B or C denoting the relative importance of the area according to the research criteria.
In particular, the following nine criteria were used to evaluate the different areas being examined:

1) The area represents a **distinctive and unusual landform** within the municipality, Ontario and Canada.

2) The area serves a **vital ecological function** such as **maintaining the hydrologic balance** over a widespread area, i.e. it serves as a water storage or recharge area.

3) The **plant and/or animal communities** of the area are identified as unusual or of **high quality locally** within the municipality, Ontario or Canada.

4) The area is an **unusual habitat** with limited representation in the municipality, Ontario or Canada, or a small remnant of particular habits which have virtually disappeared within the municipality.

5) The area has an **unusually high diversity of biological communities** and associated plants and animals due to a variety of geomorphological features, soils, water, sunlight and associated vegetation and microclimatic effects.

6) The area provides **habitat for rare or endangered species** that are endangered Regionally, Provincially or Nationally.

7) The area **is large and undisturbed**, potentially affording a sheltered habitat for species which are intolerant to human disturbance.

8) The location of the area, combined with its natural features, make it particularly **suitable for scientific research and conservation education purposes**.

9) The combination of landforms and habitats is identified as having **high aesthetic value in the context of the surrounding landscape** and any

alteration would significantly lower its amenity value.

Areas were rated either A, B or C according to the number of criteria which the area fulfilled, with the sole exception of one area which was given an A status even though only two criteria were fulfilled. This exception was included because the area in question is the last remnant of a once very common habitat in the Region. Areas fulfilling four or more criteria were given an A rating, areas fulfilling between one and three criteria were given a B rating, and areas fulfilling none of the criteria listed were given a C rating in the Ecologistics Report compiled by the four conservation authorities. Only those areas given an A or B rating were deemed important enough to be included in the Region's Official Plan as Environmentally Sensitive Areas. Of the 44 areas looked at in the Ecologistics Report, 37 areas merited an A or B rating and were included in the Official Plan.

MAP NO. 4

LEGEND

ENVIRONMENTALLY SENSITIVE AREAS

1 Beverly Swamp
2 Valens
3 Fletcher Creek Swamp Forest (Crieff Bogg)
4 Hyde Tract, Rockton Tract and Beverly Sparrow Field
5 Rockton Wetland
6 Westover Wetland
7 Westover Drumlin Field
8 Forestry and Wildlife Area
9 Hayland Forestry and Wildlife Area
10 Millgrove Woodlot
11 Donald Farm Wetland
12 Christie Conservation Area
13 Spenser Gorge (Webster's and Tew's Falls)
14 Borer's Falls - Rock Chapel
15 Royal Botanical Gardens - Cootes Paradise
16 Summit Muskeg Preserve
17 Copetown Woods
18 Dundas Valley
19 Tiffany Falls
20 Hamilton Mountain (Radial Line)
21 Ancaster Creek Headwater
22 Hamilton Niagara Escarpment
23 Red Hill Creek - King's Forest
24 Felker's Falls and Niagara Escarpment
25 Niagara Escarpment - Devil's Punch Bowl East
26 Hydro Islands
27 Toll Gate Ponds
28 Red Hill Creek Marsh - Van Wagner's Marsh
29 Lake Medad
30 Saltfleet Woodlot
31 Tweedside Forest
32 Woodburn Floodplain
33 Sinclairville Lowland Forest
34 Hamilton Golf and Country Club
35 Mountsberg
36 Bronte Creek Ravine
37 Carlisle Swamp

ENVIRONMENTALLY SENSITIVE AREAS

Planning & Development Department
Hamilton - Wentworth Region

Table 2: Legislation Pertinent to Protective Management in the Great Lakes

Legislation	Agency	Protective Management Categories	General Purpose of Legislation
National Parks Act (Parks Canada Policy)	Environment Canada, Parks "	National Park, Nat. Historic Park, Nat. Marine Park, Canadian Landmark, Can. Heritage River, Cooperative Heritage Area	Designation & management of heritage areas, education, recreation
Migratory Birds Convention Act	Canadian Wildlife Service	Migratory Bird Sanctuary	Protect migratory birds & their habitat
Canada Wildlife Act	Canadian Wildlife Service	National Wildlife Area, Cooperative Wildlife Area	Protect migratory bird & other wildlife habitat
Fisheries Act	Fisheries & Oceans Canada, Ministry of Natural Resources	"areas for the ...propagation of fish"	Fisheries regulation & management, habitat protection
Ontario Fishery Regulations	Ministry of Natural Resources	fish sanctuary, restricted fishing areas	Fisheries regulation & management
Provincial Parks Act	"	Wilderness, Park, Natural Environment Park, Nature Reserve, Recreation Park, Waterway Park, Historic Park	Protection, recreation & education
Wilderness Areas Act	"	Wilderness Area	Protection of Wilderness Areas
Game & Fish Act	"	Wildlife management area, agreement area, crown game preserve	Wildlife management
Public Lands Act	Ministry of Natural Resources	reserve, zoning, restricted areas	Management of crown lands
Mining Act	"	withdrawal	Management of mining activities on crown lands
Beach Protection Act	"	none	Management of sand & gravel extraction from coastal areas
Lakes & Rivers Improvement Act	"	none	Management of habitat alterations
Ontario Heritage Act	Ontario Heritage Foundation	cooperative arrangements	Protection for cultural & natural heritage
Conservation Authorities Act	Conservation Authorities	Conservation Area, cooperative arrangements	Water management, recreation
(Fill, Construction & Alteration to Waterways Regulations)	"		Protection of flood plains & hazard lands
Planning Act	Ministry of Municipal Affairs & Housing, municipalities	zoning for restricted uses	Municipal land use planning